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Description

The invention relates to a method and an arrangement for aligning two objects in accordance with the preambles of claims 1 and 7.

5   Modern manufacturing methods often require two objects to be precisely aligned with respect to each other; this requirement is particularly important in optical or corpuscular-beam lithography which is used e.g. for manufacturing highly integrated circuits. The alignment accuracy of a mask with respect to already existing structures on an object must be about 1/10 of the smallest dimensions that are to be defined; this need is difficult to be met with conventional alignment techniques now that line widths are decreasing under

10   1 μm. A further difficulty with high precision alignment is caused by the increasing size of the wafers (5 inches or more) which require a step-and- repeat process to transfer the image of the individual chip fields to the wafer. Preferably each chip field should then be aligned individually to compensate for distortions of the large wafer during hot-process manufacturing steps. For high throughput such an individual alignment step should not take more than fractions of a second which is difficult to achieve with the required high

15   precision.

Methods for automatic alignment have therefore been proposed along various lines. One makes use of image processing techniques where alignment marks on a mask are imaged onto corresponding marks on the wafer. The digital evaluation of this image yields alignment data; that method, however, requires a high quality optical system and clear wafer marks undisturbed by overlaying layers.

20   Periodic alignment marks have also been proposed to replace conventional marks like crosses, chevrons and the like. Gratings yield accurate displacement information and are rather insensitive to disturbances of individual grating lines. In an article "A new interferometric alignment technique" by D.C. Flanders and H.I. Smith identical gratings are provided on both the mask and the wafer. Relative alignment of these gratings is indicated if symmetrical diffraction orders show the same intensity. Measurement of

25   relative intensities, however, requires close control of the optical system; in addition this method is only applicable to proximity printing.

H.P. Kleinknecht describes in SPIE, vol. 174, page 63 (1969) "Diffraction gratings as keys for automatic alignment in proximity and projection printing" where the mask grating has half the grating constant of the wafer grating so that new diffraction orders appear upon alignment. Therefore this method is also based on

30   intensity evaluations.

European patent application 45321 describes an overlay measurement technique where phase differences are measured that occur when a grating is displaced. For the overlay measurements two gratings on the wafer are evaluated, one of the gratings being generated from the mask adjacent to a reference grating. This is not suitable for the alignment process as such.

35   It is therefore the object of the present invention to provide a method and an arrangement for alignment of the aforementioned kind that yield high accuracy, operate with high speed, and are little disturbed by manufacturing influences.This object is achieved by the invention described in claims 1 and 7; embodiments of the invention are characterized in the dependent claims.

The invention applies to a lithographic projection system where mask and wafer are arranged in two

40   optically conjugate planes. An optical transmission grating is provided in the mask and illuminated by a collimated light beam, e.g. a laser; two symmetrical diffraction orders, e.g. the $\pm$ 1. orders are then focussed by the imaging system in one common spot on the optical grating that is provided on the wafer and has the same grating constant as the image of the mask grating. The two incident diffraction orders are diffracted a second time at the wafer grating to return along the optical axes and to be deflected by a semi-transparent

45   mirror to a photo detector whose output signal is evaluated for the relative phase difference of the two diffracted beams. For that purpose the phase of the two beams that are diffracted at the mask is changed periodically in three steps, e.g. by a thin oscillating glass plate arranged in series to the mask grating.

The proposed alignment method can be extended to two dimensions by using crossed gratings in mask and wafer and by rotating the plane of polarisation in the diffracted beams for the Y direction so that these

50   beams can be separated by a polarizing beam splitter and be directed to a separate photo detector.

After the actual alignment has been measured the glass plate (or two glass plates with perpenticular axes of rotation) can be tilted to achieve fine alignment of the mask image with respect to the wafer without any further mechanical displacement.

The invention combines a very high alignment accuracy up to 25 nanometer with very short alignment

55   times in the order of 0.1 sec. This makes it particularly interesting for step-and-repeat projection systems with high throughput. Alignment can be performed in X- and Y-direction. As the method is independent of the distance between the mask and wafer it can be applied to all projection systems and yields good alignment signals even if additional layers are deposited on the wafer grating and if a part of the grating is

slightly distorted. The optical path for the alignment beams can be arranged at the periphery of known optical systems so that it can be incorporated without deteriorating the imaging quality.

Embodiments of the invention are now described in detail with reference to the accompanying drawings in which equal reference numerals designate equal or equivalent elements.

Fig. 1 shows a schematic diagram of a first embodiment of the invention allowing a one-dimensional alignment.

Figs. 2 A, B show a second embodiment of the invention allowing a two-dimensional alignment.

Figs. 3 A, B show in front and side view a third embodiment of the invention with an off-axis implementation in a conventional photo- lithographic system.

Fig. 4 shows a schematic block diagram of an embodiment with attached peripheral control devices.

The principle of the invention is now discussed with reference to Fig. 1 which shows the key elements of a photo-lithographic system in which a beam of light 1 illuminates a photo-lithographic mask 3 that is imaged by optical system 7 onto a wafer 8 whose surface is covered with a photosensitive layer. Mask 3 contains in this embodiment a linear optical grating 3a with a grating constant g_m and approximate dimensions of 100 μm x 100 μm. This grating is a pure amplitude object and may be realized by a chromium pattern on the transparent mask substrate. It is preferably arranged in the kerf zones between the chip fields.

Before exposing mask 3 with beam 1 grating 3a has to be aligned with respect to grating 8a on wafer 8 such that the image of grating 3a coincides with grating 8a. The grating constant g_w of wafer grating 8a is therefore chosen in accordance with the linear magnification of optical system 7. In a 1:1 optical system the grating constant g_m equals constant g_w.

The wafer grating is preferably generated by imaging the mask grating on the wafer covered with a photosensitive resist over a silicon dioxide layer and etching the latter to obtain a phase grating.

In the proposed automatic alignment system grating 3a is illuminated by a laser beam 2 to yield symmetrical orders of diffraction, the first two of which are selected (e.g. by diaphragms) as shown in Fig. 1 (u_{-1}^0 , u_{+1}^0). Laser beam 2 is focussed by lens 20 to a spot of a size that covers some 10 periods of mask grating 3 and is deflected by dichroic mirror 21, which is transparent to the exposure beam 1. Optical system 7 collects the symmetrical orders of diffraction to recombine them on wafer grating 8a where they are reflected and again diffracted into 2. orders to leave grating 8a as beams u_{-1} and u_{+1} travelling along the optical axis of the system. These reflected beams are diverted by beam splitter 5 to photo detector 6 which measures the intensity of these superimposed beams. Beam splitter 5 serves also to filter out the undiffracted beam passing through grating 3.

In the alignment process, the phase grating may be covered by other layers on the wafer so that its optical efficiency risks to be reduced; the oblique illumination by the diffraction orders of the mask grating and an appropriate choice of the thickness of the wafer grating SiO_2 layer counteract to this disturbing effects.

In a first step coarse alignment is achieved by mechanically displacing either mask 3 or wafer 8 along the X direction to an accuracy of approximately $g_w/4$. If grating constants in the order of 10 μm are used the accuracy of the pre-alignment step must be ± 2.5 μm. This is achievable with conventional alignment systems, e.g. laser interferometrically controlled stages.

After this pre-alignment fine alignment is performed using a proper tiltof the glass plate 4 and without further mechanical movement. The pre-alignment step is only required one per wafer.

The electrical output signal of photodetector 6 depends on the intensity and therefore on the relative phase of the interfering superimposed beams u_{-1} and u_{+1}. As a displacement Δ X of a grating is known to generate a phase change of

$$\Delta \pi = 4 \pi \Delta X / g \quad (1)$$

the phase of the electrical signal depends both on the position of the mask grating 3a and the wafer grating 8a. This phase difference may be represented by:

$$\Psi_m = 4 \pi \left(\frac{\Delta X_m}{g_m} + \frac{\Delta X_w}{g_w} \right) \quad (2)$$

If an additional phase shift of equal amount but of opposite sign is introduced by the glass plate in the diffracted beams $u_{-1}0$ and $u_{+1}0$ the beams to be superimposed at photodetector 6 may be represented in

3

complex notation by:

$$u_{+1} = A \cdot e^{i\left(\frac{\psi_m}{2} + \frac{\psi}{2}\right)} \qquad (3)$$

$$u_{-1} = A \cdot e^{i\, -\left(\frac{\psi_m}{2} + \frac{\psi}{2}\right)} \qquad (4)$$

where A is the amplitude of the wave. The intensity measured at photodetector 6 is then:

$$J = |u_{+1} + u_{-1}|^2 = J_o |1 + \cos(\psi + \psi_M)| \qquad (5)$$

$$J_o = 2A^2$$

In the absence or at a horizontal position of the glass plate alignment is achieved if

$$\Delta X_M / g_M = -\Delta X_W / g_W \qquad (6)$$

or equivalently

$$\psi_M = 0 \qquad (7)$$

The phase ψ_M in the electrical output signal and thus the misalignment is determined by measuring the intensity at three points in the cosine function of equation 5 which are mutually spaced by $2/3\pi$. For that purpose the optical phase difference between partial beams u_{+1} and u_- is varied from $\phi = 0$ to $\phi = 2/3\pi$ and $\phi = -2/3\pi$ by means of tiltable glass plate 4 with thickness d that is arranged between mask 3 and optical system 7. If this glass plate is oriented horizontally, both diffracted beams pass symmetrically and have no relative phase difference. A tilt angle α however introduces a mutual phase difference in the two beams of

$$\psi = 4\pi \cdot \frac{d}{g_M} \cdot \sin\alpha \cdot \left(1 - \frac{\cos\alpha}{\sqrt{n^2 - \sin^2\alpha}}\right) \qquad (8)$$

where
d   = thickness of the plate
n   = index of refraction,
since each beam experiences a different thickness of the plate on its path through the glass plate. Simultaneously the tilting causes a virtual displacement of the mask grating with respect to the wafer grating.

For a thickness d = 300μm and with a grid constant g_M = 20 μm angles of $\alpha \pm 2°$, the required phase differences of $\pm 2/3\pi$ are achieved.

If the intensities measured at these three tilt angles are then noted by J_R, J_T and J_S, the phase ψ_m can be calculated from the equation

$$\psi_m = \tan^{-1} \frac{\sqrt{3}(J_T - J_R)}{2\, J_S - J_R - J_T} \mod 2\pi \qquad (9)$$

Equation 9 is known in the field of optical overlay measurements and has been cited in the article "Interferometric method for checking the mask alignment precision in the lithographic process" by G. Makosch and F. J. Schönes in Applied Optics, Vol. 23, no. 4, 14 February 1984, page 629, for an optical

system that uses an electro-optical modulator to introduce phase shifts between partial beams.

During the measurement process the glass plate is wobbled around a tilting axis (perpendicular to the plane of the paper in Fig. 1) with a frequency in the khz range, e.g. by an galvanometric scanner. The evaluation of the electric output signal can thus be performed in fractions of a second.

The evaluation of the phase in the electrical output signal can be performed with high accuracy in the order of $6 \cdot 10^{-3}\pi$ yielding alignment precisions in the order of 25 μm when grating constants in the order of 10μm are used.

The phase measurement in the electrical output signal yields both the amount and the direction of the mask or wafer displacement that is required to achieve alignment. These values can be fed to a servo mechanism or alternatively to the actuator of the glass plate. In the latter case tilting of the glass plate shifts the image of mask 3 on wafer 8 prior to the exposure process so that fine alignment is achieved without further mechanical movement.

Fig. 2 shows a second embodiment which allows for simultaneous alignment in two orthogonal directions, the X- and Y direction. The incident laser beam 2 is therefore directed to a crossed grating 3a (with equal grating constants in both directions) to be split up into four partial beams u_{-1}^{0}, u_{+1}^{0}, u_{+1}^{1}, u_{-1}^{1} which all traverse tiltable glass plate 4, and a modified beam splitter plate 5 to be focussed by optical system 7 into one spot on wafer 8 which carries a second crossed grating 8a that corresponds to mask grating 3a in accordance with the linear magnification of optical system 7. The axis of rotation of tilted glass plate 4 is oriented at 45° with respect to the planes defined by the two pairs of diffracted beams, so that mutual phase differences in the beam pairs are introduced by simply rotating glass plate 4.

In order to differentiate between the diffracted beams in the X- and Y-direction beam splitter 5 has two areas 5a which are covered by a $\lambda/2$ layer at the points of intersection with the Y-partial beams u_{-1}^{1} and u_{+1}^{1}. Thus the polarisation direction of the Y-beams is rotated by 90° with respect to the X-beams and both pairs of partial beams can be separated by polarizing beam splitter 6c and directed to corresponding photo detectors 6a and 6b. (The polarisation direction of the beams is indicated in Fig. 2A by . and -, resp.)

The center of beam splitter 5 is covered by a dichroic mirror 5b which totally reflects the partial beams u however is completely transparent to the exposure radiation 1.

The embodiments of Figs. 1 and 2 use simple optical elements and can be manufactured with high precision so that the imaging quality of the optical lithographic system should not be deteriorated. This applies in particular to the thin glass plate and the low tilting angles used even in the case of optical fine alignment.

In other optical systems where geometrical constraints or quality requirements do not allow the insertion of any other optical elements the invention may also be implemented using marginal rays; an example of such a system is shown in Fig. 3.

Two laser beams 2a, 2b are directed off-axis to dichroic deflection mirror 21 and illuminate 2 crossed gratings $3a_1$, $3a_2$ arranged at the periphery of mask 3. The diffracted orders then pass two tiltable glass plates 4a, 4b, providing a phase shift for the X-and Y-directions, resp. A glass plate with a 45° rotation axis could be used instead.

The optical system comprises in this embodiment two focussing elements 7a, 7b which image the mask gratings $3a_1$, $3a_2$ onto corresponding wafer gratings $8a_1$ and $8a_2$, resp. The beam splitter 5 to couple out the beams diffracted at wafer masks 8a is arranged between the system components 7a, 7b and generates two output beams at its points of intersection 5a, 5b; each of these beams consists of two superimposed diffraction orders (e.g. ±1.) and is guided separately to an associated photo detector.

Further embodiments of the invention can use higher diffraction orders (to increase the sensitivity of the method) and/or mask and wafer gratings with different constants as long as the requirement is fulfilled that colinear output beams are generated whose phase differences can be evaluated.

Instead of a reflecting grating on wafer 8, a transmission grating can also be used with the photodetector 6 being arranged behind this grating.

In Fig. 4 the actuator and control elements of an embodiment are shown to be attached to a suitably programmed computer 45, e.g. a personal computer.

Computer 45 issues and receives digital signals through Digital/Analog converters 44a, 44b and Analog/Digital converters 44c, resp. The misalignment between mask 3 and wafer 8 is indicated by a display counter 46.

In this embodiment, mask 3 can be displaced mechanically by a piezoelectric transducer 4 with an associated amplifier 42. The exact position of mask 3 is sensed by an inductive probe 40 whose output signal is converted to digital form in A/D converter 44c.

The glass plate 4 is tilted by scanner driver 43 which also sets a constant tilt angle for fine alignment after the amount of misalignment has been determined by computer 45.

Claims

1. Method for aligning two objects in conjugate planes of an imaging system, the objects having first (3a) and second (8a) optical gratings, resp., the first grating being illuminated by a light beam (2) characterized in that first symmetrical diffraction orders (u_{+1}^0 , u_{-1}^0) from the first grating (3a) are selected, that the selected diffraction orders are focussed by the imaging system (7) coincidently on the second grating (8a) to be diffracted a second time into second diffraction orders (u_{+1}, u_{-1}) colinear to the optical axis of the imaging system, that the phase relationship between the first diffracted beams is modulated periodically and that the relative phase of the second diffraction orders in the colinear output beam is evaluated.

2. The method of claim 1, wherein the gratings are linear and parallel to each other for alignment in a direction perpendicular to the grating bars.

3. The method of claim 1, wherein the gratings are crossed gratings for alignment in two orthogonal directions perpendicular to the bars of the crossed gratings and wherein the polarisation directions of the second diffraction orders in each orthogonal direction are perpendicular to each other.

4. The method of one of the claims 1 - 3, wherein the relative phase of the super imposed second diffraction orders is determined by measuring the intensity after shifting the relative phase of the first diffraction orders by $\pm 2/3\pi$.

5. The method of one of the claims 1 - 4, wherein the first grating is part of a photolithographic mask and the second grating is part of a wafer to be exposed photolithographically.

6. The method of one of the claims 1 - 5, wherein the optical path of the diffracted beams is arranged at the periphery of the optical imaging system.

7. Apparatus for aligning two objects in conjugate planes of an imaging system, the objects having a first and a second optical grating, resp., and comprising means to illuminate the first optical grating with vertical incidence, for carrying out the method of one of the claims 1 - 6,
characterized in that a tiltable glass plate (4) is arranged optically behind the first grating, that the second optical grating (8a) is a reflective grating, and that a semitransparent mirror (5) is arranged in the optical axis of the imaging system to direct the light diffracted at the second grating along the optical axis to a photo detector (6).

8. The apparatus of claim 7, wherein the first and second gratings are crossed gratings, each generating a pair of diffracted beams in orthogonal planes, wherein the axis of rotation of the tiltable glass plate is arranged under 45° with respect to orthogonal planes, wherein the semitransparent mirror (15) has areas covered by a $\lambda/2$ layer at the intersections with one pair of diffracted beams and wherein a polarizing beam splitter (6c) is provided in the output beam to direct the pairs of diffracted beams to different photodetectors (6a, 6b).

9. The apparatus of claim 7 or 8, wherein the tiltable glass plate is oscillated by a galvanometric actuator.

10. The apparatus of one of the claims 7 - 9, wherein the glass plate is tilted for fine adjustment of the objects by a constant angle in accordance with the measured misalignment.

Revendications

1. Méthode d'alignement de deux objets dans des plans conjugués d'un système d'image, les objets ayant un premier réseau optique (3a) et un second réseau optique (8a) respectivement ; le premier réseau étant illuminé par un faisceau de lumière (2), caractérisée par le fait que l'on choisit les premiers ordres de diffraction symétrique (u_{+1}^0 , u_{-1}^0) du premier réseau (3a), que l'on focalise de façon coïncidente ces ordres de diffraction choisis par le sytème d'image (7) sur le second réseau (8a) pour être diffractés une seconde fois en seconds ordres de diffraction (u_{+1} , u_{-1}) colinéaires avec l'axe optique du système d'image ; par le fait que l'on module de façon périodique la relation de phase entre les premiers faisceaux diffractés, et par le fait que l'on mesure la phase relative des seconds ordres de

diffraction dans le faisceau de sortie colinéaire.

2. Méthode selon la revendication 1, dans laquelle les réseaux sont linéaires et parallèles entre eux pour un alignement dans une direction perpendiculaire aux traits du réseau.

3. Méthode selon la revendication 1, dans laquelle les réseaux sont des réseaux croisés pour un alignement dans deux directions orthogonales perpendiculaires aux traits des réseaux croisés, et dans laquelle les directions de polarisation des seconds ordres de diffraction dans chaque direction orthogonale sont perpendiculaires entre elles.

4. Méthode selon l'une des revendications 1 à 3, dans laquelle la phase relative des seconds ordres de diffraction surimposés est déterminée en mesurant l'intensité après avoir décalé la phase relative des premiers ordres de diffraction de ± 2/3 π.

5. Méthode selon l'une des revendications 1 à 4, dans laquelle le premier réseau fait partie d'un masque photolithographique et le second réseau fait partie d'un substrat devant être traité par photolitographie.

6. Méthode selon l'une des revendications 1 à 5, dans laquelle le trajet optique des faisceaux diffractés est placé à la périphérie du système d'image optique.

7. Appareil d'alignement de deux objets dans des plans conjugués d'un système d'image, les objets ayant un premier et un second réseaux optiques respectivement, et comprenant des dispositifs d'illumination du premier réseau optique avec une incidence verticale, pour appliquer la méthode selon l'une des revendications 1 à 6, caractérisé par le fait qu'une plaque de verre inclinable (4) est disposée optiquement derrière le premier réseau, que le second réseau optique (8a) est un réseau réfléchissant et qu'un miroir semi-transparent (5) est placé dans l'axe optique du système d'image pour diriger sur un photodétecteur (6) la lumière diffractée le long de l'axe optique au niveau du second réseau.

8. Appareil selon la revendication 7, dans lequel le premier et le second réseaux sont des réseaux croisés, produisant chacun une paire de faisceaux diffractés dans des plans orthogonaux, dans lequel l'axe de rotation de la plaque de verre inclinable est à 45° par rapport aux plans orthogonaux, dans lequel le miroir semi-transparent (15) a des surfaces couvertes par une couche λ/2 aux intersections avec une paire de faisceaux diffractés et dans lequel un séparateur de faisceau polarisant (6c) est placé dans le faisceau de sortie pour diriger les paires de faisceaux diffractés sur différents photodétecteurs (6a, 6b).

9. Appareil selon la revendication 7 ou 8, dans lequel la plaque de verre inclinable est orientée par un dispositif galvanométrique.

10. Appareil selon l'une des revendications 7 à 9, dans lequel la plaque de verre est inclinée pour un ajustement fin des objets avec un angle constant conformément au défaut d'alignement mesuré.

Patentansprüche

1. Verfahren zum Ausrichten zweier Objekte in konjugierten Ebenen eines Abbildungssystems, wobei die Objekte erste (3a) bzw. zweite (8a) optische Gitter aufweisen und das erste Gitter von einem Lichtstrahlenbündel (2) beleuchtet wird, dadurch gekennzeichnet, daß erste symmetrische Beugungsordnungen (u_{+1}^0, u_{-1}^0) vom ersten Gitter (3a) ausgewählt werden, daß die ausgewählten Beugungsordnungen durch das Abbildungssystem (7) zusammenfallend auf das zweite Gitter (8a) abgebildet werden, um dort ein zweites Mal in zweite Beugungsordnungen (u_{+1}, u_{-1}) gebeugt zu werden, die kolinear zur optischen Achse des Abbildungssystems verlaufen, daß die Phasenbeziehung zwischen den ersten Beugungsbündeln periodisch modelliert wird und daß die relative Phase der zweiten Beugungsordnungen im kolinearen Ausgangsstrahlenbündel ausgewertet wird.

2. Das Verfahren nach Anspruch 1, bei dem die Gitter linear und parallel zueinander angeordnet sind, um eine Ausrichtung senkrecht zu den Gitterstrichen zu ermöglichen.

3. Das Verfahren nach Anspruch 1, bei dem die Gitter gekreuzte Gitter darstellen, um eine Ausrichtung in

zwei orthogonalen Richtungen senkrecht zu den Gitterstrichen der gekreuzten Gitter zu ermöglichen und bei dem die Polarisationsrichtungen der zweiten Beugungsordnungen in jeder orthogonalen Richtung senkrecht zueinander stehen.

4. Das Verfahren nach einem der Ansprüche 1 bis 3, bei dem die relative Phase der überlagerten zweiten Beugungsordnungen bestimmt wird, indem die Intensität gemessen wird, nachdem die relative Phase der ersten Beugungsordnungen um ± 2/3π verschoben wird.

5. Das Verfahren nach einem der Ansprüche 1 bis 4, bei dem das erste Gitter Teil einer photolithographischen Maske ist und das zweite Gitter Teil eines Wafers, der photolithographisch belichtet werden soll.

6. Das Verfahren nach einem der Ansprüche 1 bis 5, bei dem der optische Pfad der Beugungsbündel an der Pheripherie des optischen Abbildungssysystems angeordnet ist.

7. Einrichtung zur Ausrichtung zweier Objekte in konjugierten Ebenen eines Abbildungssystems, wobei die Objekte ein erstes bzw. ein zweites optisches Gitter aufweisen sowie Vorrichtungen zur Beleuchtung des ersten optischen Gitters mit senkrechter Inzidenz zur Durchführung des Verfahrens nach einem der Ansprüche 1 bis 6,
dadurch gekennzeichnet, daß eine schwenkbare Glasplatte (4) optisch hinter dem ersten Gitter angeordnet ist, daß das zweite optische Gitter (8a) ein Reflektionsgitter ist und daß ein halbdurchlässiger Spiegel (5) in der optischen Achse des Abbildungssystems angeordnet ist, um das am zweiten Gitter gebeugte Licht längs der optischen Achse zu einem Photodetektor (6) zu leiten.

8. Einrichtung nach Anspruch 7, bei der die ersten und zweiten Gitter gekreuzte Gitter darstellen, wobei jedes ein Paar gebeugter Strahlenbündel in senkrechten Ebenen erzeugt, wobei die Rotationsachse der schwenkbaren Glasplatte unter 45° bezüglich der orthogonalen Ebenen angeordnet ist, wobei der halbdurchlässige Spiegel (15) Gebiete aufweist, die mit einer λ/2 Schicht bei den Durchtrittspunkten mit einem Paar von gebeugten Strahlenbündeln belegt ist und bei dem ein polarisierender Strahlenteiler (6c) im Ausgangsstrahl vorgesehen ist, um die Paare von gebeugten Bündeln zu verschiedenen Photodetektoren (6a, 6b) zu leiten.

9. Einrichtung nach Anspruch 7 oder 8, bei der die schwenkbare Glasplatte durch einen galvanometrischen Aktuator in Schwingungen versetzt wird.

10. Einrichtung nach einem der Ansprüche 7 bis 9, bei der die Glasplatte zur Feinausrichtung der Objekte um einen konstanten Winkel gemäß der gemessenen Fehlausrichtung geschwenkt wird.
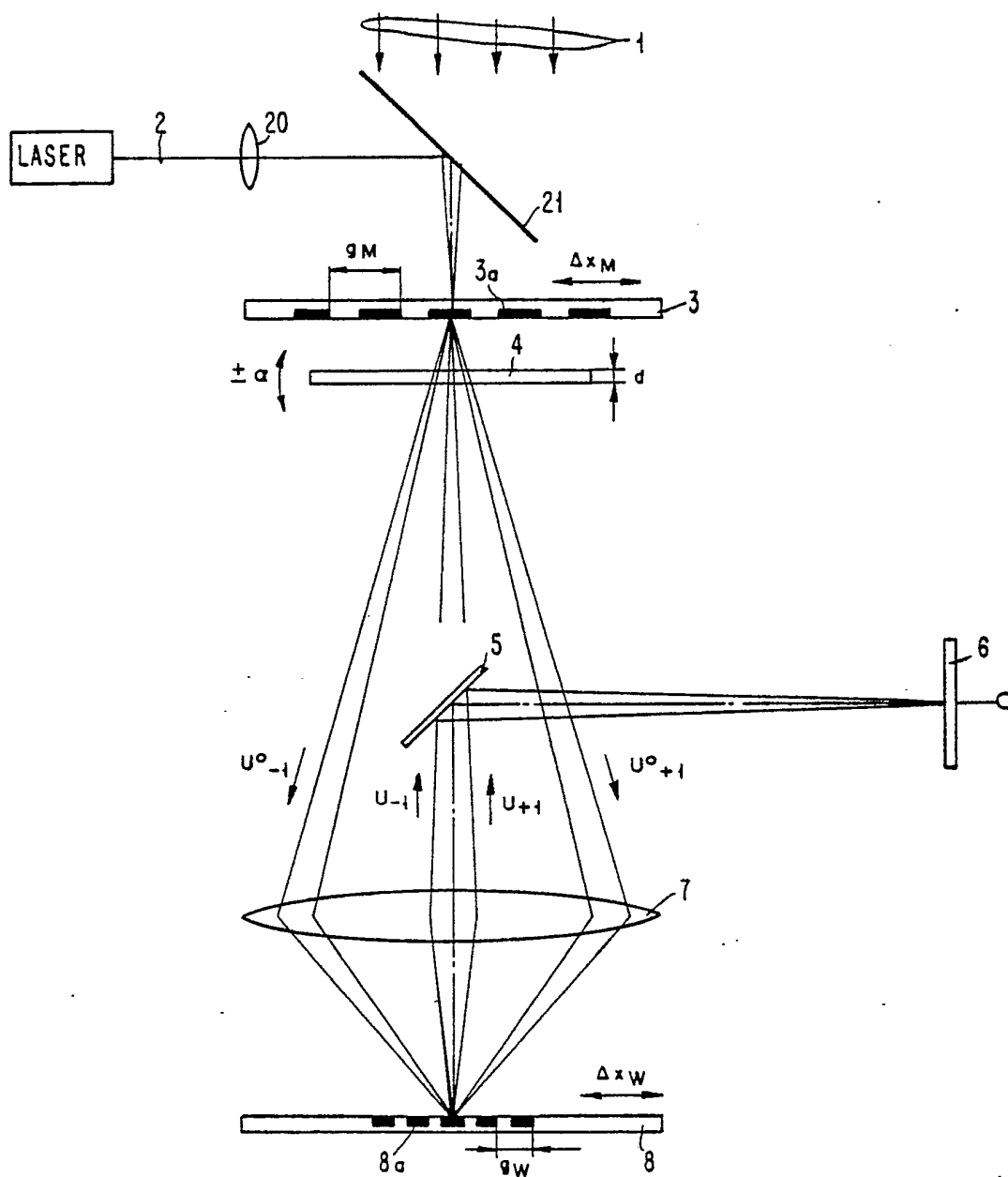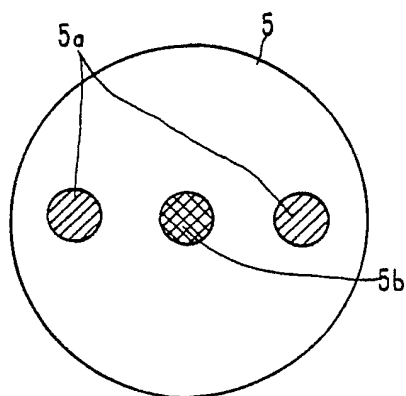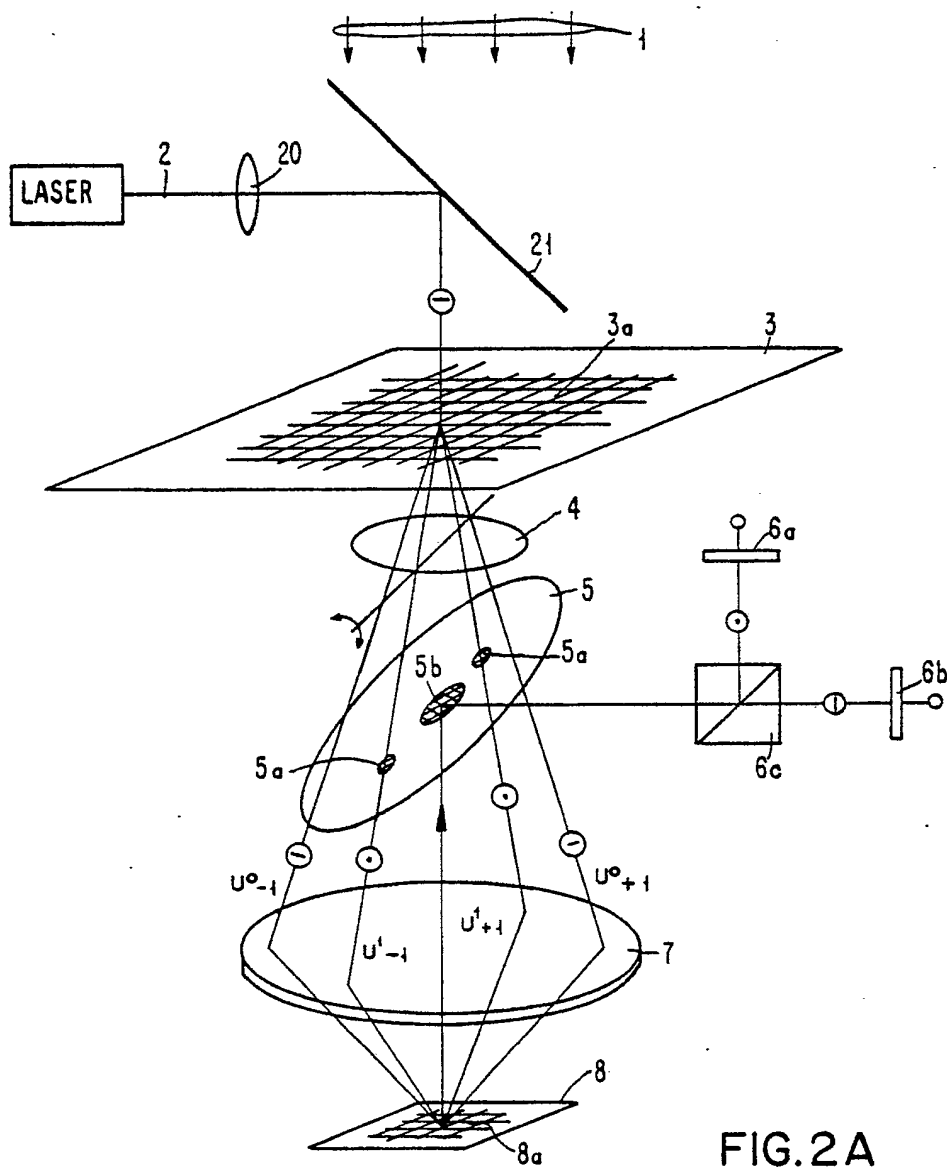
FIG. 1

FIG. 2A

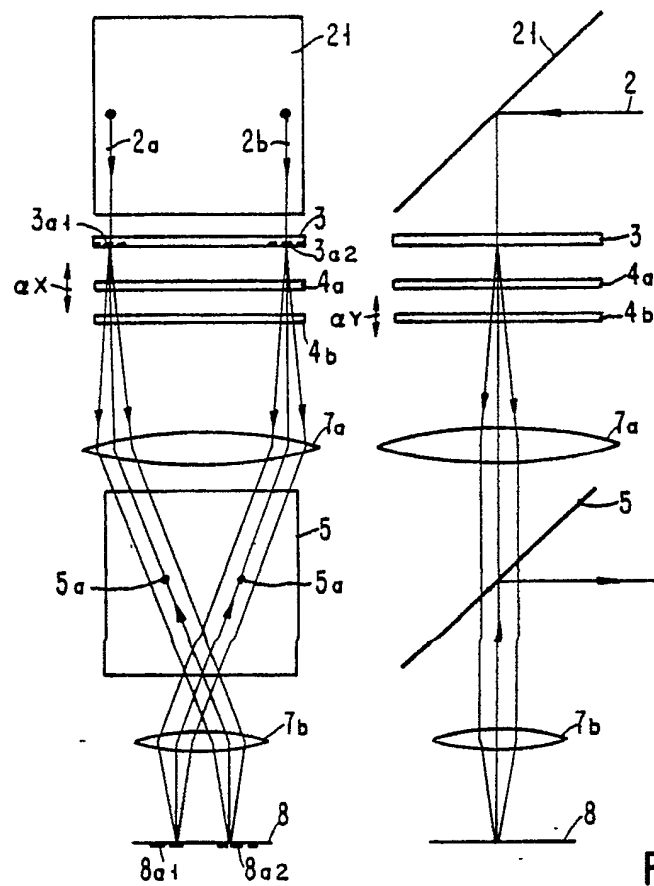FIG. 2B

FIG.3

FIG. 4